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In the Claims:

Please cancel claims 1-35 and replace with the following:

- (New) A dynamically controllable photonic crystal comprising: 36.
- a structure having a periodic variation in dielectric constant and a) including a semiconductor substrate with at least one isolated resonant local defect positioned therewithin, the semiconductor substrate further comprising a three-layer structure comprising a center layer bordered by two external layers, the center layer having a higher equilibrium charge carrier concentration than the two external layers; and
- an electrical mechanism operative to perform local depletion of charge b) carriers from the center layer in the vicinity of the at least one resonant local defect;

whereby the local depletion results in localized carrier refraction that enables dynamic control of electromagnetic wave propagation through the photonic crystal.

- (New) The dynamically controllable photonic crystal of claim 36, wherein the 37. three-layer structure defines two junctions, and wherein the electrical mechanism includes electrical biases applied to the two junctions.
- (New) The dynamically controllable photonic crystal of claim 37, wherein the 38. three-layer structure includes a structure selected from the group consisting of a PN⁺P structure, a NP⁺N structure, a NN⁺N structure, and a PP⁺P structure.
- (New) The dynamically controllable photonic crystal of claim 37, wherein the 39. semiconductor is silicon.

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- 40. (New) A dynamically controllable silicon photonic crystal comprising:
- a) a silicon substrate with a periodic array of air rods disposed therewithin and having a three-layer structure comprising a center layer bordered by two external layers, the center layer having a higher equilibrium charge carrier concentration than the two external layers, the three-layer structure further including at least one isolated resonant local defect; and
- b) an electrical mechanism operative to perform local depletion of charge carriers from the center layer in the vicinity of the at least one resonant local defect;

whereby the local depletion results in a localized carrier refraction that enables dynamic control of electromagnetic wave propagation through the photonic crystal.

- 41. (New) The dynamically controllable photonic crystal of claim 40, wherein the three-layer structure defines two junctions, and wherein the electrical mechanism includes electrical biases applied to the two junctions.
- 42. (New) The dynamically controllable photonic crystal of claim 41, wherein the three-layer structure includes a structure selected from the group consisting of a PN⁺P structure, a NP⁺N structure, a NN⁺N structure, and a PP⁺P structure.
- 43. (New) A dynamically controllable photonic crystal comprising:
- a. a structure having a periodic variation in dielectric constant and including a semiconductor substrate with at least one isolated resonant local defect positioned therewithin;

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b. a local carrier concentration column formed in the semiconductor substrate around the at least one local defect and operative to have its carrier concentration changed electrically;

whereby the column carrier concentration change results in a local carrier refraction effect that may be used to dynamically control electromagnetic wave propagation through the photonic crystal.

- 44. (New) The dynamically controllable photonic crystal of claim 43, wherein the periodic variation in dielectric constant is effected by a periodic array of equal diameter air rods foormed in the semiconductor substrate, and wherein the local defect includes an air rod with a different diameter that the equal diameter.
- 45. (New) The dynamically controllable photonic crystal of claim 44, wherein the electrically induced change is effected by at least two nanocontacts formed on the semiconductor substrate.
- 46. (New) The dynamically controllable photonic crystal of claim 44, wherein the column carrier concentration change includes a change selected from the group consisting of a carrier concentration increase and a carrier concentration decrease.
- 47. (New) The dynamically controllable photonic crystal of claim 45, wherein the periodic variation is defined by a lattice constant, and wherein a lateral dimension of each nanocontact is substantially no larger than three lattice constants.
- 48. (New) The dynamically controllable photonic crystal of claim 46, wherein the at least two nanocontacts include two nanocontacts defining a two-terminal device.

- (New) The dynamically controllable photonic crystal of claim 46, wherein the 49. at least two nanocontacts include three nanocontacts defining a three-terminal device.
- (New) The dynamically controllable photonic crystal of claim 45, wherein the 50. carrier concentration column includes a three-layer structure having a center layer with a lower equilibrium carrier concentration than the concentrations of two external layers, the three-layer structure selected from the group consisting of a PIN structure, a PNP struture, a NPN structure, a N+NN+ structure, a P+PP+ structure and a MSM structure.
- (New) The dynamically controllable photonic crystal of claim 45, wherein the 51. carrier concentration column includes a three-layer structure having a center layer with a higher equilibrium carrier concentration than the concentrations of two external layers, the three-layer structure selected from the group consisting of a PN+P structure, a NP⁺N structure, a NN⁺N structure, and a PP⁺P structure.
- (New) The dynamically controllable photonic crystal of claim 44, wherein the 52. semiconductor is silicon.
- (New) The dynamically controllable photonic crystal of claim 52, wherein the 53. carrier concentration column includes a structure selected from the group consisting of a symmetric CCD structure and a MOS structure.
- (New) The dynamically controllable photonic crystal of claim 44, wherein the 54. at least one air rod with a different diameter includes a plurality of coupled air rods with the same different diameter defining at least one coupled-cavity waveguide.

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55. (New) The dynamically controllable photonic crystal of claim 54, wherein the at least one coupled-cavity waveguide is used to implement a device selected from the group consisting of a tunable optical filter, a tunable optical router, a tunable optical modulator and an optical switch.